

# **Geostationary Operational Environmental Satellite (GOES)**

**GOES-R Series**

## **Unique Instrument Interface Document (UIID) Space Environment In-Situ Suite (SEISS)**

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## 1 Scope

The purpose of this Unique Instrument Interface Document (UIID) is two-fold. The first is to allocate GOES-R series spacecraft resources to the Space Environment In-Situ Suite (SEISS). The second is to serve as a core building block on which the SEISS-spacecraft interface can be designed. The spacecraft integrating contractor and the SEISS contractor **shall** meet each of their respective interface requirements as defined in this document.

The Government **will** be the system integrator until a system performance contractor or spacecraft contractor with that responsibility is selected. Until that time, the Government **will** be responsible for accommodation trades, resource allocation (weight, power, space, bandwidth, etc.), and resolving interface issues. This UIID **will** govern the development of an Interface Control Document (ICD). The ICD development **will** be a joint activity of the SEISS and spacecraft contractors.

The SEISS ICD establishes the details of the electrical, communications, mechanical, thermal, integration and test, and command and data handling (C&DH) interfaces between the SEISS instrument and the GOES-R spacecraft. After the ICD is signed and approved by all parties, the spacecraft contractor **shall** maintain the ICD.

The SEISS particle sensors **shall** monitor the proton, electron, and heavy ion fluxes at geosynchronous orbit. The particle sensors include a magnetospheric particle sensor (MPS), an energetic heavy ion sensor (EHIS), and a solar and galactic proton sensor (SGPS).

This SEISS requires primary power and command input data from the spacecraft. Instrument output data to the spacecraft contains instrument information, instrument telemetry and ancillary data.

### 1.1 Document Overview

Together, the General Interface Requirements Document (GIRD) and the SEISS UIID establish the SEISS spacecraft interface requirements. The GIRD applies to all GOES-R instruments while the SEISS UIID is specific to the SEISS. Section 1 explains the use of this document. Section 2 lists reference documents. Section 3 allocates spacecraft resources, such as mass, power, and data rate, to the SEISS instrument Suite. Section 4 contains verification guidelines. Section 5 contains government-accepted operation constraints. Section 6 contains government-accepted deviations from the GIRD.

### 1.2 Conflicts

Within the hierarchy of GOES-R spacecraft documentation, the SEISS Performance and Operational Requirements Document (SEISS PORD) **shall** take precedence over the SEISS UIID. In the event of any other unresolved conflict, the National Aeronautics and Space Administration (NASA) contracting officer **shall** determine the order of precedence.

### **1.3 Interface Control Management**

The configuration management/control of this document **will** be maintained by the GOES Project Configuration Control function. Additions, deletions, or modifications to this document **may** be initiated by any participating agency by submittal and approval of a Contract Change Notice (CCN) or technical directive.

### **1.4 Missing Requirements**

This document contains all performance requirements for the sensor except those labeled “TBD”, “TBS”, and “TBR”. The term “TBD” (To Be Determined) means that the contractor **shall** determine the missing requirement in coordination with the government. The term “TBS” (To Be Specified) indicates that the government **will** supply the missing information in the course of the contract. The term “TBR” (To Be Reviewed) implies that the requirement is subject to review for appropriateness by the contractor or the government. The government **may** change “TBR” requirements in the course of the contract.

### **1.5 Definitions**

The following definitions apply:

#### **1.5.1 Shall**

The requirements in this document are not of equal importance or weight. “**Shall**” designates the highest weighting, i.e. mandatory. Any deviations from these contractually imposed mandatory requirements require the approval of the NASA contracting officer.

#### **1.5.2 Should**

“**Should**” designates an intermediate weighting, i.e. not mandatory. Unless required by other contract provisions, noncompliance with “**should**” requirements does not require contracting officer approval, but **shall** require documented technical substantiation.

#### **1.5.3 Will**

“**Will**” designates a lower weighting level. The “**will**” requirements indicate the intent of the Government and are often stated as examples of acceptable designs, items and practices. Unless required by other contract provisions, noncompliance with the “**will**” requirements does not require approval of the NASA contracting officer and does not require documented technical substantiation.

#### **1.5.4 May**

“**May**” designates the lowest weighting level. It is a requirement that is a possibility and is at the discretion of the Government or contractor.

### 1.5.5 Normal Operational Periods

Normal operational periods are defined as all periods except during SEISS in-flight calibration mode.

### 1.5.6 Instrument Data Latency

Elapsed time from end of data collection in the instrument to the time that the data is available at the instrument /spacecraft interface.

### 1.5.7 Spacecraft Data Latency

Elapsed time from when instrument data is available at the instrument /spacecraft interface until it is transmitted to the ground.

## 2 Applicable Documents

The following documents are referenced in this specification.

## 3 Allocations

The GOES-R spacecraft **shall** provide data downlink, telemetry and power for the SEISS instruments throughout the entire spacecraft mission including transfer orbit, yaw flips and eclipse periods. The following paragraphs allocate these resources to SEISS.

### 3.1 *Command and Data Handling*

#### 3.1.1 SEISS-to-Spacecraft Data

##### 3.1.1.1 SEISS-to-Spacecraft Data Volume

The SEISS data rate including all SEISS housekeeping data and packet overhead data **shall** be no more than 300 bits per second (TBR).

##### 3.1.1.2 SEISS-to-Downlink Data Latency

The spacecraft **shall** meet a latency requirement of no more than 5 seconds (TBR) to downlink SEISS Data.

#### 3.1.3 Spacecraft Telemetry Required for SEISS Data Processing

Spacecraft telemetry required to analyze SEISS data **shall** be provided whenever SEISS data is available, with the same latency specified for the SEISS data in paragraph

3.1.1.2. The housekeeping data that is required to analyze the SEISS data includes:

- Spacecraft attitude data
- Spacecraft INR data
- Spacecraft thruster status
- (TBR)

### **3.1.4 Spacecraft Command of SEISS after Launch**

The spacecraft **shall** provide the capability to turn on the SEISS within one hour (TBR) after launch.

## **3.2 Power**

### **3.2.1 Average Power**

The SEISS **shall** draw no more than 92 Watts (TBR) averaged over five (5) minutes (TBR).

### **3.2.2 Peak Power**

The SEISS **shall** draw no more than 100 (TBR) Watts over 30 seconds (TBR).

### **3.2.3 Survival Power**

The SEISS **shall** require no more than 35 watts (TBR) to maintain survival temperatures.

## **3.3 Mechanical**

The requirements in this section apply to the structural and mechanical components of the SEISS flight units.

### **3.3.1 Mass Properties**

The SEISS, including all units and cabling between units, **shall** have mass less than 42 kilograms (TBR).

### **3.3.2 Volume**

The instrument, including mounts, thermal blankets and connectors for both stowed and operational configurations **shall** have dimensions that do not exceed a total volume of 85,000 cu. cm. (TBR).

### **3.3.3 Mounting**

The spacecraft **shall** provide mounting space for the SEISS on the three axis stabilized body of the spacecraft. The SEISS packages **shall** be installed on the spacecraft from the exterior of the spacecraft. All of the SEISS packages **shall** be removable from the fully assembled spacecraft and re-installable without the removal of other spacecraft components.

#### **3.3.3.1 Mounting Direction of MPS**

The spacecraft **shall** provide mounting for the Magnetospheric Particle Sensor either the Earth or Anti-Earth face of the spacecraft.

#### **3.3.4 Field of View**

The spacecraft **shall** provide the following field of view (FOV) for the SEISS instruments:

### 3.3.4.1 Magnetospheric Particle Sensor FOV

The spacecraft **shall** provide two orthogonal 170 by 30 degrees (TBR) fields of view for the Magnetospheric Particle Sensor.

### 3.3.4.2 Solar and Galactic Proton Sensor

The spacecraft **shall** provide TBD field of view for the Solar and Galactic Proton Sensor.

### 3.3.4.3 Energetic Heavy Ion Sensor

The spacecraft **shall** provide greater than TBD conical FOV for the Energetic Heavy Ion Sensor, centered on local zenith or the anti-earth direction.

### 3.3.5 Contamination

The spacecraft **shall** limit contamination on the SEISS, accumulated over the life of the spacecraft to TBD

## 4 Instrument Constraints

In order to ensure proper instrument performance or to prevent possible instrument damage, the following Government-approved constraints are imposed by the instrument developer on spacecraft integration and test activities, including launch, activation and operations.

## 5 Deviations and Waivers

This section identifies General Instrument Requirements Document (GIRD) requirements that the government has relaxed or waived for this instrument. Where appropriate, corresponding GIRD paragraph titles and numbers are identified in parentheses. There are no deviations or waivers at this time.

## 6 Acronyms

C&DH	command and data handling
CCR	configuration change request
EHIS	Energetic Heavy Ion Sensor
FOV	field of view
GIRD	General Instrument Requirements Document
GOES	Geostationary Operational Environmental Satellite
GSFC	Goddard Space Flight Center
Hz	Hertz
ICD	Interface Control Document
kg	kilogram
m	meter
Mbps	million bits per second
MPS	Magnetospheric Particle Sensor
NASA	National Aeronautics and Space Administration

P <sup>3</sup> I	Pre-Planned Product Improvement
PORD	Performance and Operation Requirements Document
SEISS	Space Environment In-Situ Suite
SGPS	Solar and Galactic Proton Sensor
TBD	to be determined
TBR	to be reviewed
TBS	to be specified
UIID	Unique Instrument Interface Document